

N67-80398

(ACCESSION NUMBER)	JR 57435	(PAGES)	5
(NASA CR OR TMX OR AD NUMBER)		(THRU)	
		(CODE)	5
		(CATEGORY)	

June 15, 1962

Space Electric Power Office
 National Aeronautics and Space Administration
 Lewis Research Center
 21000 Brookpark Road
 Cleveland 35, Ohio

Attention: Mr. Herman Schwartz

Subject: Monthly Progress Report on Contract NAS3-2526

Gentlemen:

Detailed construction drawings have been prepared for fabrication of the new vortex generator. Fabrication of the generator, a brief description of which appeared in the previous progress report, will be underway soon. In the design of the test configuration for this generator, consideration is being given to a cesium vapor seeding system. A source of reasonably priced, 99 percent pure cesium has been located. The impurities consist of nine percent other alkali metals plus one percent other contaminants (mostly oxygen) by weight. The advantages of employing cesium vapor rather than aqueous solutions of cesium compounds for seeding include plasma formation with fewer constituents, elimination of conductivity reduction effects due to the presence of hydroxyl radicals, and extended generator component lifetimes because of the elimination of oxygen.

Preliminary efforts were initiated to determine the practical limitations of a 7070 computer program to solve the thermodynamic performance of vortex generators. The study of a suitable program will constitute a low level of effort until better information is developed, particularly in the areas of turbulence and field induced nonequilibrium conductivity.

An experimental method, capable of determining independently both the nonequilibrium conduction effects as well as the boundary layer plus sheath resistance, is presently being examined. This experimental approach is based primarily on a technique of measuring the potential field gradient at constant current density in an X-10 channel which has one movable electrode. Bearing any unforeseen developments in the analysis of this method, experiments will be undertaken in the forthcoming period.

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Observations of tufted mentioned above from the vortex chamber in a semi-plastic model of a vortex generator revealed laminar flow at a radial Reynolds number estimated to be $Re_r \approx 50$ and turbulent flow at $Re_r \approx 100$ and above. Clotted centerbodies appeared to be ineffective in altering the flow pattern or in stagnating the tangential velocity in the turbulent regime and for the range of radius ratios ($r_c/r_c = 0.25, 0.5, \text{ and } 0.75$) employed. This is in contrast to previous experience with porous or screen type centerbodies. All flows in this single jet-driven vortex exhibit angular dependence which extends throughout the vortex cavity.

A new model of this vortex chamber has been designed which will facilitate complete internal surveys by axially orientated Pitot probes. Another feature of this chamber is the provision for altering the radial point of jet injection in order to study the influence of the outer cylindrical wall shear on the jet velocity recovery. Fabrication of this chamber is expected to be completed in the forthcoming period. The results of velocity and pressure surveys in the chamber will be useful in the formulation, now in progress, of a new theory to account for the angular dependence mentioned above.

Very truly yours,

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